TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. ITL.1016US

In Re Application Of: **Chris E. Barns et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/629,127	July 29, 2003	Khanh B. Duong	21906	2822	5928

Invention: **Preventing Silicide Formation at the Gate Electrode in a Replacement Metal Gate Technology**

COMMISSIONER FOR PATENTS:

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Dated: **December 28, 2005**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Applicant:			
	Chris E. Barns et al.	Art Unit:	2822
Serial No.:	10/629,127	Examiner:	Khanh B. Duong
Filed:	July 29, 2003	Atty Docket:	ITL.1016US P16703
For:	Preventing Silicide Formation at the Gate Electrode in a Replacement Metal Gate Technology	Assignee:	Intel Corporation

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APPEAL BRIEF

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Nancy Meshkoff

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REAL PARTY IN INTEREST

The real party in interest is the assignee Intel Corporation.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF CLAIMS

Claims 1-14 (Rejected).

Claim 15 (Canceled).

Claims 16-19 (Rejected).

Claims 20-24 (Withdrawn).

Claims 25-28 (Rejected).

Claims 1-14, 16-19, and 25-28 are rejected and are the subject of this Appeal Brief.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

In the following discussion, the independent claims are read on one of many possible embodiments without limiting the claims:

1. A method comprising:

covering a polysilicon gate structure (14) with a hard mask (16) to prevent the formation of a silicide on the gate structure, said mask and said gate structure having opposed, common vertical surfaces (Figure 1, page 4, lines 1-16); and

forming a sidewall spacer (17) that extends along a vertical surface and covers said gate structure (14) and covers at least part of said mask (Figure 1, page 4, lines 17-20); and

removing said hard mask (16) using an etch that is selective of the hard mask over the spacer (Figure 2, page 5, lines 11-17).

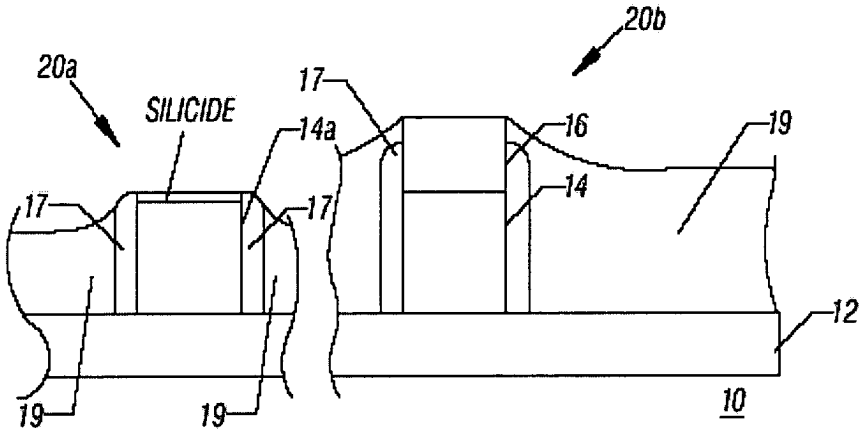

FIG. 1

14. A method comprising:

selectively preventing the formation of a silicide on a first polysilicon gate structure (14) using a hard mask (16) over said first polysilicon gate structure (14) (Figure 1, page 4, lines 1-16);

forming a silicide on a second polysilicon gate structure (14a) (Figure 1, page 4, lines 21-24);

removing the hard mask (16) using a selective etch (Figure 2, page 5, lines 11-17); and

replacing the first polysilicon gate structure (14) with a metal gate replacement (18) (Figure 3, page 6, lines 1-8).

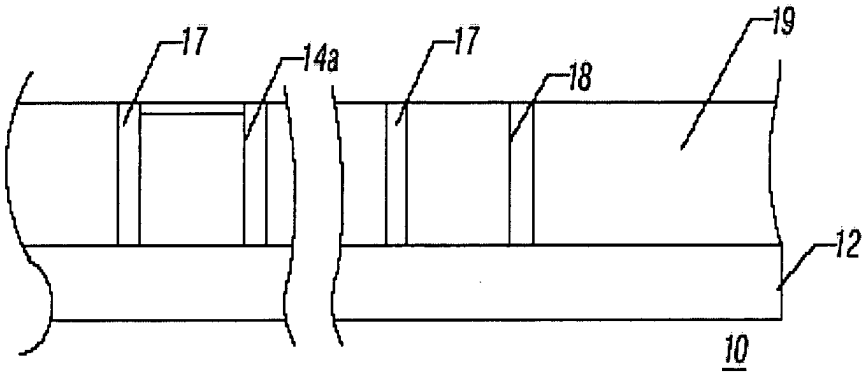

FIG. 3

At this point, no issue has been raised that would suggest that the words in the claims have any meaning other than their ordinary meanings. Nothing in this section should be taken as an indication that any claim term has a meaning other than its ordinary meaning.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. **Are Claims 1-3 and 5-12 Anticipated by Lee?**

B. **Are Claims 14, 16-19, and 25-27 Unpatentable Over Lee '648 in View of Lee '530?**

ARGUMENT

A. Are Claims 1-3 and 5-12 Anticipated by Lee?

Claim 1 calls for removing a hard mask using an etch that is selective of the hard mask over the spacer. A polysilicon gate structure is covered with a hard mask to prevent the formation of the silicide on the gate structure. A sidewall spacer extends along a common surface and covers the gate structure and covers at least part of the mask.

The claim was rejected under Section 102 based on the '530 Lee patent. On one hand it is asserted that although Lee teaches a CMP process or a stripping process, the stripping process is inherently selective. In order to be inherently selective, it must necessarily be selective.

The citation to the Yeh patent is inappropriate to support inherency. Either the process necessarily occurs in Lee, in which case it is inherent, or it does not. Whatever happens in Yeh is completely irrelevant to that analysis. Any attempt to bolster a Section 102 rejection with a second reference would also be inappropriate.

In order to be inherent, something must necessarily happen. See M.P.E.P. § 2112. Here, the thing that must necessarily happen is that the mask is removed by an etch that is "selective of the hard mask over the spacer." There is no such inherency here. One of the alternatives is to use CMP which is inherently non-selective and would etch the mask and the layer 152 equally. Thus, the reference teaches one alternative which is necessarily non-selective. Thus, there is no reason to believe that the other etch would necessarily be selective. It could be selective or non-selective and there is no teaching of making any selective removal.

Moreover, it is suggested that the layer 152 may subsequently be removed any way. Layer 152 is apparently what the Examiner asserts to be the sidewall spacer. It is explained that "the layer 152 may be left in place or stripped." See column 4, line 22. Thus, if it does not matter whether it is left in place or stripped, it equally well does not matter whether it ends up getting etched some or not.

Thus, not only does the reference fail to teach inherently selectively etching the hard mask over the spacer, but it teaches away from the same. It suggests that it does not matter what you do to the spacer relative to the hard mask.

There is no basis to conclude that Lee necessarily uses a selective etch of the hard mask over the spacer. Again, this is because he teaches a CMP process that is not selective, he

suggests removing the spacer 152 or not, as the user desires, both of which indicate that selectivity is of no concern. Moreover, there is nothing which suggests that selectivity is necessary in the stripping process step one. Rather than being inherent, it seems much more likely that the stripping process is non-selective since there is no concern about preserving the layer 152 for the reasons described above.

Figure 7 from the reference is modified in the Evidence Appendix to indicate the deposition of the layer 72 which, the Examiner indicates in the advisory action, is the reason for the maintenance of the rejection. The reason for doing this is that the layer which is blanket deposited is never shown, only the results after additional processing is shown in Figure 8. Thus, in modified Figure 7, it is shown how the layer 72 would necessarily have looked as blanket deposited. See column 4, lines 9 and 10. This would be followed by a chemical mechanical planarization step which the Examiner suggests is selective. However, to remove the hard mask 52, that so-called selective step would have to remove all the material shown in hatching in the appendix figure. Thus, not only is the hard mask 52 removed, but a large portion of the layer 72 is removed, namely, the portion of the layer over and along the sides of the layer 52. Thus, there is no way to say that that mechanical polishing process is selective of the hard mask over the layer 72. If it were, no etching would ever occur.

To the extent there is some argument that the claim may also read on a stripping process, it is noted that stripping is referred to in column 4, lines 17-20. However, this is only applied if "such a process is not used." Then, the remaining portion of layer 52/152 is stripped, exposing the poly 30 in the gate. Obviously, such a process is the blanket deposition of the nitride 72. In other words, it is saying that if you do not do that, then the only way to expose the gate 30 is to simply strip off the layers 52 and 152. Clearly, such stripping cannot be selective because it takes the material 152 and 52 off equally and no layer 72 would ever have been used.

The argument in the advisory action that the sidewall spacers 72 remain after the removal process is incorrect. Some portion of them remains but, as pointed out above, a substantial portion of them was removed. If this were not so, there would have been no way to remove the mask which would have been protected by the overlying portion of the layer 72.

While it is conceded that any stripping process might be selective, there is no basis to believe that any stripping process in the cited reference was selective of a hard mask over the spacer.

Therefore, the rejection of claim 1, based on Lee, should be reversed.

B. Are Claims 14, 16-19, and 25-27 Unpatentable Over Lee '648 in View of Lee '530?

Claim 14 calls for selectively preventing the formation of a silicide on a first polysilicon gate structure using a hard mask over the first polysilicon gate structure. The claim calls for forming a silicide on the second polysilicon gate structure. The third clause states that the hard mask is removed using a selective etch. Certainly "the" hard mask that is referred to in the third clause is the only hard mask in the claim. That is the hard mask over the first polysilicon gate electrode.

The examiner attempts to read the claim on the reference by reading the claim on the etching away of the hard mask over the *second* polysilicon gate structure (which mask is removed before the silicide is formed). This is an impermissible and totally precluded reading of the claim.

If that were not enough, the claim calls for removing the hard mask using a selective etch. The examiner reads the claim element on Figure 5 which shows one side of the structure, the memory FET, covered by a mask 28, over the first polysilicon gate structure. If the etch was really selective, a mask would not be needed. The attempt to read the claim onto a nonselective etch that uses a mask makes no sense. The etch described in the reference is nonselective, and that is why the mask 28 is needed. If a "selective etch" were used, no such mask would be necessary. The etch does not change its character because of any masking. The fact that there is masking proves that the etch was not selective.

The attempt to combine the two Lee patents also does not meet the statutory requirements. There is no teaching of doing the first three steps in order to enable replacement with a metal gate replacement. In other words, the Lee '648 patent teaches no reason to do the first three steps as described above and certainly provides no reason to do those steps in order to replace the first polysilicon gate structure with a metal gate replacement. In other words, preventing the formation of the silicide on the first polysilicon gate structure enables it to be removed since removing such a structure with silicide is more difficult. Lee '648 simply removes a polysilicon gate structure without the need to be concerned about silicide on one of two gate structures. The claimed invention calls for a situation where one gate has silicide on it

and the other does not, so that the one that does not have the silicide can be removed to form a replacement metal gate. The formation of two structures, one with silicide and one without, in order to facilitate replacement of the one polysilicon structure and one metal gate structure is not taught in either reference or their combination, nor is any rationale to make the claimed modification.

Therefore the rejection of claim 14 and its dependent claims should be reversed.

Applicant respectfully requests that each of the final rejections be reversed and that the claims subject to this Appeal be allowed to issue.

Respectfully submitted,

Date: December 28, 2005

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CLAIMS APPENDIX

The claims on appeal are:

1. A method comprising:

covering a polysilicon gate structure with a hard mask to prevent the formation of a silicide on the gate structure, said mask and said gate structure having opposed, common vertical surfaces; and

forming a sidewall spacer that extends along a vertical surface and covers said gate structure and covers at least part of said mask; and

removing said hard mask using an etch that is selective of the hard mask over the spacer.

2. The method of claim 1 including protecting the polysilicon gate structure with a hard mask to prevent the formation of a silicide.

3. The method of claim 2 including protecting the polysilicon gate structure with a nitride hard mask to prevent the formation of a silicide.

4. The method of claim 1 including selectively protecting at least one polysilicon gate structure with the mask to prevent the formation of a silicide and removing the mask over another gate structure to form a silicide on the another gate structure.

5. The method of claim 1 including removing said mask after forming a silicide.

6. The method of claim 5 including removing said mask by etching.

7. The method of claim 5 including removing said mask by polishing.

8. The method of claim 5, including polishing said mask then etching said mask.

9. The method of claim 1 including replacing the polysilicon gate structure with a metal gate replacement.

10. The method of claim 1 including forming the polysilicon gate structure including a patterned polysilicon portion and an underlying dielectric layer.

11. The method of claim 10 including protecting the underlying dielectric layer from overetching.

12. The method of claim 1 including forming spacers on either side of said polysilicon gate structure to prevent lateral silicide formation.

13. The method of claim 5 including using a two-step polish to remove said mask including a first step using a harder pad and a second step using a softer pad.

14. A method comprising:

selectively preventing the formation of a silicide on a first polysilicon gate structure using a hard mask over said first polysilicon gate structure;

forming a silicide on a second polysilicon gate structure;

removing the hard mask using a selective etch; and

replacing the first polysilicon gate structure with a metal gate replacement.

16. The method of claim 14 including preventing the formation of silicide by masking the first polysilicon gate structure to be replaced with metal.

17. The method of claim 16 including protecting the first polysilicon gate structure with a hard mask to prevent the formation of a silicide.

18. The method of claim 17 including protecting the first polysilicon gate structure with a nitride hard mask to prevent the formation of a silicide.

19. The method of claim 14 including preventing the formation of a silicide by forming a mask over said first polysilicon gate structure and removing said mask after forming a silicide.

25. The method of claim 14 wherein said hard mask is nitride.

26. The method of claim 25 wherein said first polysilicon structure includes sidewall spacers.

27. The method of claim 26 wherein an etch is used that is selective of said nitride.

28. The method of claim 27 including using H_3PO_4 to etch said mask.

EVIDENCE APPENDIX

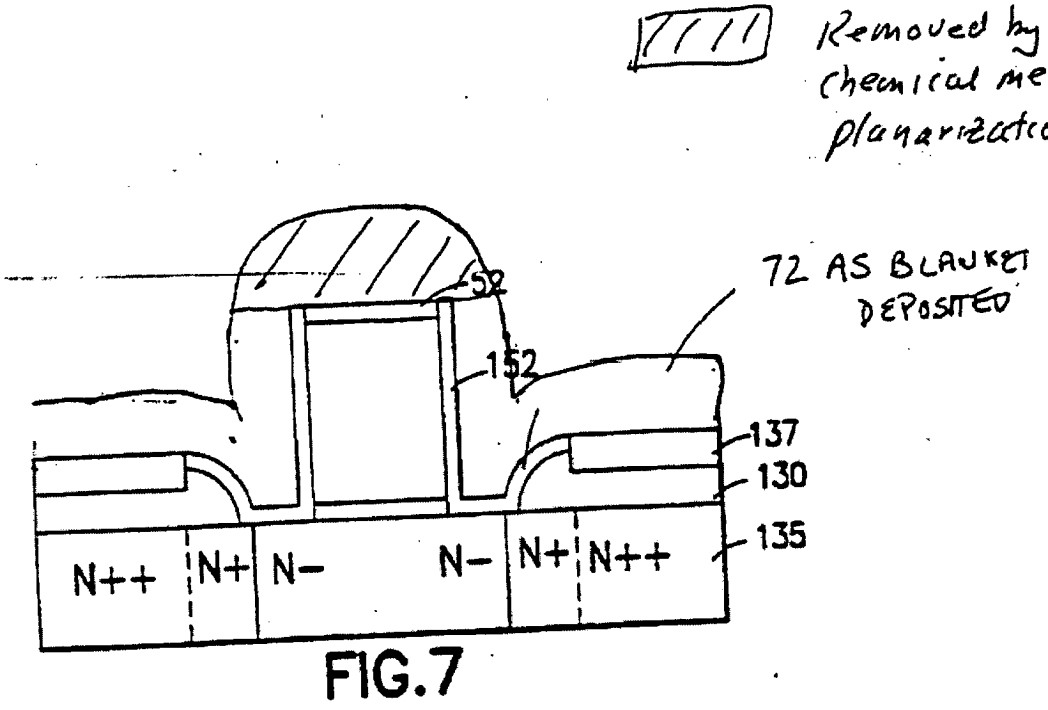

FIG.7

LEE '530 MODIFIED

RELATED PROCEEDINGS APPENDIX

None